In the first breaking down of the sperm head a number of chromatin vesicles are formed equal to the number of chromosomes in the sperm.

The polar bodies are formed about the time the egg enters the glandular portion of the oviduct. They lie between the vitelline membrane and the cytoplasm.

In cell division, cytoplasmic currents are present. These currents precede nuclear division, and outline the paths by which the daughter nuclei later migrate apart. They are not confined to the immediate neighborhood of the nuclei, but extend into the region of the future blastomeres.

The spindles and asters are very minute in comparison with the size of the blastomeres and the appearance and curved paths of the currents indicate that cytoplasmic division is due to amœboid movements rather than to the tension of astral fibers.

The Development of Color in the Definitive Feather: R. M. STRONG.

The colors of feathers, as was pointed out by Bogdanow ('58), Gadow ('82) and others, are due to the presence of pigment or to special conditions of structure. The pigmentation of the feather takes place in the earlier stages of the development of the feather. The dark brown pigments, commonly classed as melanins, appear to be formed in the cytoplasm of epithelial cells which are differentiated to produce pigment. These pigment cells, or chromatophores, send out branched processes to those cells which are to form pigmented elements of the future feather. Pigment granules pass from these pigment-cell processes into the cells composing the feather fundament. The formation and the distribution of pigment cease before cornification has proceeded far. There is no redistribution of pigment after the feather is fully formed and has burst forth from the sheath enclosing the feather germ.

A New Type of Hyper-metamorphosis: JAMES G. NEEDHAM.

This paper will be published in *Psyche.*

An Experimental Study of Regulation in Stenostoma: C. M. CHILD.

When portions are removed from chains of *Stenostoma* regeneration is complete, provided the piece is not below a certain size. In addition to the regeneration, the piece becomes more slender and narrower, the change first appearing, except under certain conditions, at the posterior end and extending anteriorly until it includes the whole body. The piece does not acquire the same proportions as the original, but approaches them more or less closely.

To explain this change, it is necessary, first, to examine the methods of locomotion and the locomotor structures of *Stenostoma.* The animal, like other rhabdocœls, is covered with cilia which constitute the locomotor organs.

When undisturbed, *Stenostoma* shows a strong tendency to attach itself to the substratum. The attachment by the tail, which is used as a sucker, is especially frequent and the tail adheres more closely than any other part of the ventral surface.

Most of the time when the animal is attached the lateral and dorsal cilia are vibrating and are thus acting in opposition to the organs of attachment; the result is the subjection of the body to a certain amount of mechanical tension. That such tension does exist is evident from a large number of observations.

If we suppose the animal to be attached by the posterior end and the lateral and dorsal cilia vibrating with equal speed and force, the tension upon the tissue at any cross section of the body will be proportional to the number of cilia which are anterior to that cross section, *i. e.,* the ten-

sion will be greatest at the posterior end and null at the anterior end of the body, with a complete gradation between the two extremes.

The chains of *Stenostoma* always taper posteriorly, as would be expected if this tension is effective in modifying form.

The elongation and decrease in transverse diameter of pieces are exactly what might be expected if the tension is effective.

And, furthermore, it is possible to prevent the change of form (morphallaxis) by preventing the animals from attaching themselves. The form change occurs very rapidly in *Stenostoma,* being complete in twenty-four hours or less. Pieces were prevented from attaching themselves during twelve hours after operation and then were compared with pieces, originally of the same size, which had been allowed to attach themselves. The pieces which had not been allowed to attach themselves were little changed, while the controls had elongated in some cases nearly half of the original length and tapered strongly to the posterior end.

It was found also that the chains attach themselves more readily to rough than to smooth glass. A little very fine sand on the bottom of a glass vessel is sufficient to cause the animal to attach itself more readily and therefore to change its form more rapidly than a specimen kept in a clean glass jar.

In all these experiments the specimens were kept without food.

The experiments show that form-regulation (morphallaxis) in *Stenostoma* is, at least in large part, purely a mechanical phenomenon, not the effect of stimuli.

Cord and Brain: J. B. Johnston.

Recent studies upon the brain and cranial nerves of lower vertebrates show that the nervous system, exclusive of the sympathetic and higher brain centers, falls into four chief *functional divisions.* These are as follows:

A. Somatic sensory division: Consisting of the free nerve endings and sense organs (neuromasts) in the integument, exclusive of end buds; nerve components innervating these organs (dorsal roots, exclusive of sympathetic fibers, V., VIII. and lateral line roots); and the nerve centers in which these components end (dorsal horn, tuberculum acusticum and cerebellum). Its stimuli give rise to reflexes which affect the animal's relations to its environment, and in higher forms commonly give rise to sensations and conscious reactions.

B. Splanchnic sensory division: Free nerve endings in the lining of the alimentary canal, sense buds in the branchial and mouth cavities, and on the surface of the head and body (end buds); components innervating these (sympathetic fibers in the dorsal roots, X., IX. and VII. roots), and centers in which these components end (Clarke's column and lobus vagi or fasciculus communis with its nuclei). Its stimuli give rise to reflexes which serve the functions of nutrition, respiration, circulation, etc.

C. Somatic motor division: The ventral horn of the cord, the nuclei of the XII., VI., IV. and III. nerves, the somatic motor fasciculus and its 'tween brain nucleus, and the motor components innervating somatic musculature.

D. Splanchnic motor division: The region of the lateral horn in the cord, the nuclei of the X., IX., VII. and V. cranial nerves; and the motor components innervating splanchnic musculature.

In the parts of the brain rostral to the medulla the splanchnic sensory and motor divisions are wholly lacking, while the somatic motor extends forward nearly to the rostral end of the brain axis and the somatic sensory division includes the cerebellum and probably the tectum opticum.